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(19) **United States**(12) **Patent Application Publication****Wabnig et al.**(10) **Pub. No.: US 2016/0218869 A1**(43) **Pub. Date: Jul. 28, 2016**(54) **SECURED WIRELESS COMMUNICATIONS**(71) Applicant: **Nokia Corporation**, Espoo (FI)(72) Inventors: **Joachim Wabnig**, Cambridgeshire (GB);
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David Bitauld, Cambridgeshire (GB)(73) Assignee: **Nokia Corporation**(21) Appl. No.: **15/090,851**(22) Filed: **Apr. 5, 2016****Related U.S. Application Data**

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(2013.01); **H04B 10/70** (2013.01)(57) **ABSTRACT**

For secure wireless communications the sender device uses a rail encoder that outputs dual rail-encoded states of light in a time slot. The states of light dual rail-encode information according to a phase and/or intensity difference between the dual rails, and the rail-encoded states of light may further be converted to a polarization-encoded state. This may be implemented using at least two polarizing beam-splitters with at least one quarter-wave plate disposed therebetween; and/or with integrated waveguides that convert three optical inputs to two optical outputs that are input to a polarization rotator-combiner. The encoder may randomly define the polarization-encoded state such as by randomly selecting from a finite number of at least $N=3$ possible polarization rotations. The recipient device may use $2N$ parallel channels to decode the dual rail-encoded states of light, each channel comprising a detector configured to detect one of N possible polarization states.

